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ing to note that the per cent of smut was greatest on the latest sowings as the experiments of Brefeld would lead us to expect. The wheat was soaked in the fungicides or subjected to their vapors in case of chloroform, etc.

The experiments which proved most successful were as follows:

No. 13. Hot water 131–132° F., 15 minutes. Smutted grains skimmed off.
No. 15. Hot water 132–131° F., 15 minutes. Smutted grains not skimmed off.
No. 21. Copper sulphate, 8 per cent., 24 hours; not limed.
No. 23. Copper sulphate, 8 per cent., 24 hours; limed.
No. 25. Copper sulphate, 5 per cent., 24 hours; not limed.
No. 27. Bordeaux mixture, 36 hours.
No. 29. Bordeaux mixture, half strength, 36 hours.
No. 45. Arsenic, saturated aqueous solution, 24 hours.
No. 57. Copper sulphate, ½ per cent. solution, 24 hours.
No. 87. Potassium bichromate, 5 per cent. solution, 20 hours.

The following table shows at a glance what has been accomplished:

Plot.	Heads smutted.	Bushels of sound grain (calculated.)
	Per cent.	*Per acre.*
Average of the untreated	71.29	4.68
No. 13	0.13	14.37
No. 15	0.82	15.36
No. 21	0.36	....
No. 23	0.31	12.52
No. 25	0.00	13.54
No. 27	0.00	....
No. 29	0.06	....
No. 45	1.09	13.75
No. 57	0.74	....
No. 87	0.00	17.01

The authors recommend the Jensen or hot-water method as the best on the whole. This treatment did not destroy quite all the smut, but it killed none of the wheat grains, and gave the largest yield except No. 87, which was only a small plot. Full directions are given for making this treatment.

The bulletin shows evidence of unusual care in preparation and a visit to the station during the progress of the experiment led me to believe that particular attention was given to all the details of the experiment, which is one involving a very great amount of painstaking labor. The graphic illustrations deserve special commendation.—ERWIN F. SMITH.

NEW SPECIES OF UREDINEÆ AND USTILAGINEÆ.

By J. B. ELLIS AND B. M. EVERHART.

SCHRŒTERIA ANNULATA, n. s. In ovaries of *Andropogon annulatus* from India (Herb. of S. M. Tracy). Mass of spores brownish black, pulverulent. Spores in twos or occasionally in threes, flattened on the line of contact, hyaline and 12–15μ diameter at first, becoming brown and separating into two distinct spores 7–10μ diameter. Epispore smooth or nearly so.

SCHIZONELLA SUBTRIFIDA, n. s. N. A. F. 2266. In flowering heads of *Cirsium ochrocentrum*. Wet Mountain Valley, Colo., July 25, 1888. Rev. C. H. Demetrio. No. 162. Spores violet or purple brown, subglobose or elliptical, soon becoming uniseptate and finally separating into two hemispherical segments. Epispore strongly tubercular-roughened, 12–20 by 12–16μ. Occasionally spores are seen with a triradiate septum much the same as in the spores of *Triphragmium clavellosum*, Berk., and in this case the spore separates into three parts instead of two, but the great majority of the spores are bifid. The fungus occupies the whole interior of the flowering heads, which become hollow and abortive.

USTILAGO DIPLOSPORA, n. s. In ovaries of *Panicum sanguinale*, Holly Springs, Miss., September 1890. Tracy No. 1551. Mass of spores dark brown. Spores of two kinds, the smaller ones globose, rough, brown, 7–8μ diameter, the larger ones 12–15μ smooth, globose, pale, nearly hyaline.

USTILAGO MONTANIENSIS, n. s. On *Muhlenbergia glomerata*, Sand Coulee, Mont., December 1887. Leg. Anderson. In the inflorescence which is rendered abortive and remains inclosed in the sheaths of the leaves. Mass of spores dark brown, nearly black. Spores subglobose, 10–14μ diameter or oblong or ovate oblong, 12–16 by 10–12μ epispore subtuberculose-reticulated, pale-brown.

ÆCIDIUM MICROPUNCTUM, n. s. On *Castilleia* from Pine Ridge, Nebr., July, 1890. Prof. T. A. Williams. Æcidia gregarious in oblong groups or patches 3–5^{mm} long and 2–3^{mm} wide, small ($\frac{1}{3}^{mm}$), sunk in the substance of the leaf, which is only slightly thickened, border narrow, erect, sublacerate. Spores subglobose or suboblong, more or less angular, smooth, 18–20μ in the longer diameter, orange yellow, approaching orange red.

ÆCIDIUM EUROTIÆ, n. s. On *Eurotia lanata*, Helena, Mont., Rev. F. D. Kelsey, June 1889, Com. F. W. Anderson. No. 514. *Æcidia hypophyllous*, arranged along each side of the midrib, short cylindrical, about $\frac{3}{4}^{mm}$ high and $\frac{1}{2}^{mm}$ broad, with a thin, suberect, sublacerated margin. Spores orange-yellow, subglobose, smooth, 15–20μ diameter.

UROMYCES SCABER, n. s. III. On leaves of some grass. Swift Creek, Custer County, Colo., October 1888. Cockerell, No. 62. Sori elliptical, bare, dark chestnut color, nearly black, $\frac{1}{2}$–1^{mm} long by $\frac{1}{2}$–$\frac{3}{4}^{mm}$ wide, pulvinate, gregarious or subconfluent. Spores globose 20–22μ or elliptical 22–25 by 20–22μ, densely echinate-scabrous, epispore scarcely thickened at the apex, pedicels subequal, hyaline, 40–50 by 4.

PUCCINIA ARABICOLA., n. s. On *Arabis* sp. Ottawa, Canada. Dr. J. Macoun, I and III.

I. Æcidia amphigenous, collected in patches or groups 2–4^{mm} across, hemispheric and closed at first, then open, small, shallow, margin slightly spreading and minutely denticulate. The spores having mostly disappeared from the rather scanty specimens, we can not now accurately describe them.

III. Sori amphigenous, scattered, small, black-brown, covered at first by the lead-colored cuticle which is at length ruptured and forms a border around the margin. Spores elliptical, oblong or obovate, rounded and thickened above, smooth, constricted at the septum, 27–40 by 20–23μ on rather stout pedicels about as long as the spores. This is quite distinct from *P. thlaspeos*, Schubert, which has the sori paler and hypophyllous and has no æcidium. *P. aberrans* (N. A. F. 1834) is also different from this.

PUCCINIA ARALIÆ, n. s. On ginseng (*Panax trifolium*), Massachusetts, May, 1888, Miss C. H. Clark and M. C. Carter, III. Parts attacked more or less distorted. Sori caulicolous and foliicolous, minute, clustered in tufts 1–2^{mm} across, naked and of a dark-brown or nearly black color, not on any definite spots though the affected leaves turn more or less distinctly light yellow, the yellow area occupying a large part of the leaf. On some of the leaves the sori were placed opposite on each side of the leaf, but in this case those on the upper surface were smaller. Spores oblong or oblong-elliptical, with fine, granular contents, and granular-roughened, pale-brown epispore scarcely thickened at the apex, which is either regularly rounded and obtuse or capped with a small hyaline papilla. Scarcely constricted, 25–35 by 15–20μ on rather slender pedicels, about as long as or a little longer than the spore itself.

PUCCINIA XANTHIIFOLIA, n. s. (*P. compositarum*, Schlect. in N. A. F. 2252.) On leaves of *Iva xanthiifolia*, Manhattan, Kans., October, 1888. Dr. W. A. Kellerman. I and II not seen. III. Sori hypophyllous scattered, bare, black, $\frac{1}{2}$–1^{mm} diameter, tuberculiform, compact. Teleutospores, elliptical or obovate-elliptical, smooth, rounded and thickened at the apex and mostly with a distinct papilla, constricted at the septum, deeply colored 35–45 by 18–23μ on long (70–80μ), slender, subpersistent pedicels. This is a very different thing from *P. compositarum*, for which, by some inexplicable error, it was distributed in N. A. F. *P. intermixta*, Pk., according to authentic specimens, is also very distinct from this.*

PUCCINIA CONSIMILIS, n. s. On leaves of *Sisymbrium linifolium*. Helena, Mont., May, 1889. Rev. F. D. Kelsey, No. 53. I and III. Hypophyllous. Acidia covering the greater part of the lower surface of the leaf. Shallow, soon open, margin sublacerate-toothed and narrowly reflexed. Æcidiospores pale yellow, subglobose or subovate, smooth, 20–23μ diameter.

III. Sori minute, $\frac{1}{2}$^{mm} diameter, crowded but not confluent and like the æcidia occupying the greater part of the lower surface of the leaf, chestnut brown, closely surrounded by the ruptured epidermis, but naked above almost from the first. Teleutospores oblong-obovate, constricted, 25–42 by 18–22μ, thickened at the apex, with or without a papilla, which when present is either central or oblique, upper cell mostly broader and darker, lower cell also generally rounded at the base, pedicels as long as or longer than the spores.

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* *Puccinia bigeloviæ*, E. and E., N. A. F. 2248, is on *Gutierrezia euthamia*, and may be only a form of *P. tanaceti*.

I and III occur together on the same leaf. The spermogonia were not observed. Possiby the *Æcidium* may be *Æcid. monoicum*, Pk., but the color of the spores is different and the cups are open almost from the first. The manner of growth is the same.

NOTES ON CERTAIN UREDINEÆ AND USTILAGINEÆ.

BY F. W. ANDERSON.

ÆCIDIUM CRASSUM, Pers., *Æcidium rhamni*, Pers., and *Æcidium pulcherrimum*, Ravenel, are identical, and are considered to be I of *Puccinia coronata*, Corda. In Sacc. Sylloge *Æcidium pulcherrimum* is retained, probably inadvertently, in specific rank, although it plainly belongs as above. No. 933 of de Thümen's Mycotheca Universalis, given as *Æcidium rhamni*, Persoon, is identical with Ravenel's specimen of *Æcidium pulcherrimum.*

NUMBER 1003 of Ellis's N. A. F. is *Æcidium ranunculacearum*, DC. But *b* of this number is *Æcidium ranunculi*, of Schweinitz. The most available, and as it appears to me fairly constant, points of distinction between these two species are as follows: *Æcidium ranunculacearum :* æcidia always in spots, preceded or accompanied by the spermogonia which are aggregated usually in the center of the æcidium spots. *Æcidium ranunculi*, Schweinitz: æcidia always effused, preceded or accompanied by the spermogonia, which are also effused and scattered, like the æcidia, indiscriminately over the surface of the leaf. Sometimes the leaf is thickly covered by the fungus and again it may bear only a cup here and there. The form of *Æcidium ranunculacearum* on *Ranunculus Cymbalaria*, so common at the West, at times shows some inclination to approach *Æcidium ranunculi* in its manner of growth, but after all never seems to lose entirely its specific characters.

ÆCIDIUM ALBUM, Clinton, in 26th Report of the New York State Museum for 1874 and *Æcidium porosum*, Peck, in Botanical Gazette, page 34, 1878, are identical. The two supposed species occur on the same host plants, and have constantly the same manner of growth from New York State to the Pacific Ocean. Herewith is given an amended description of this species: Spots none, cups few and scattered and almost superficial, or much crowded, in which case they appear to be deep-seated and give a porous appearance to the leaf surface; occupying a part or the whole of the lower surface of the leaves; frequently appearing on the stems also, in which situation they are hemispherical, or short-cylindrical, erumpent, and opening by a small, irregular, or roundish orifice. Spores from a bright orange color to almost colorless, very variable in this respect, subangular or roundish, oblong, oval or ovate, according to the free or crowded condition of the cups, 18 μ to 26 μ diameter. Saccardo in Sylloge, vol. 4, p. 787, says that *P. porosum* is distinct from *P. album*, but this can not be so.